

Beyond Control Centers

draft 1

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Control Centers



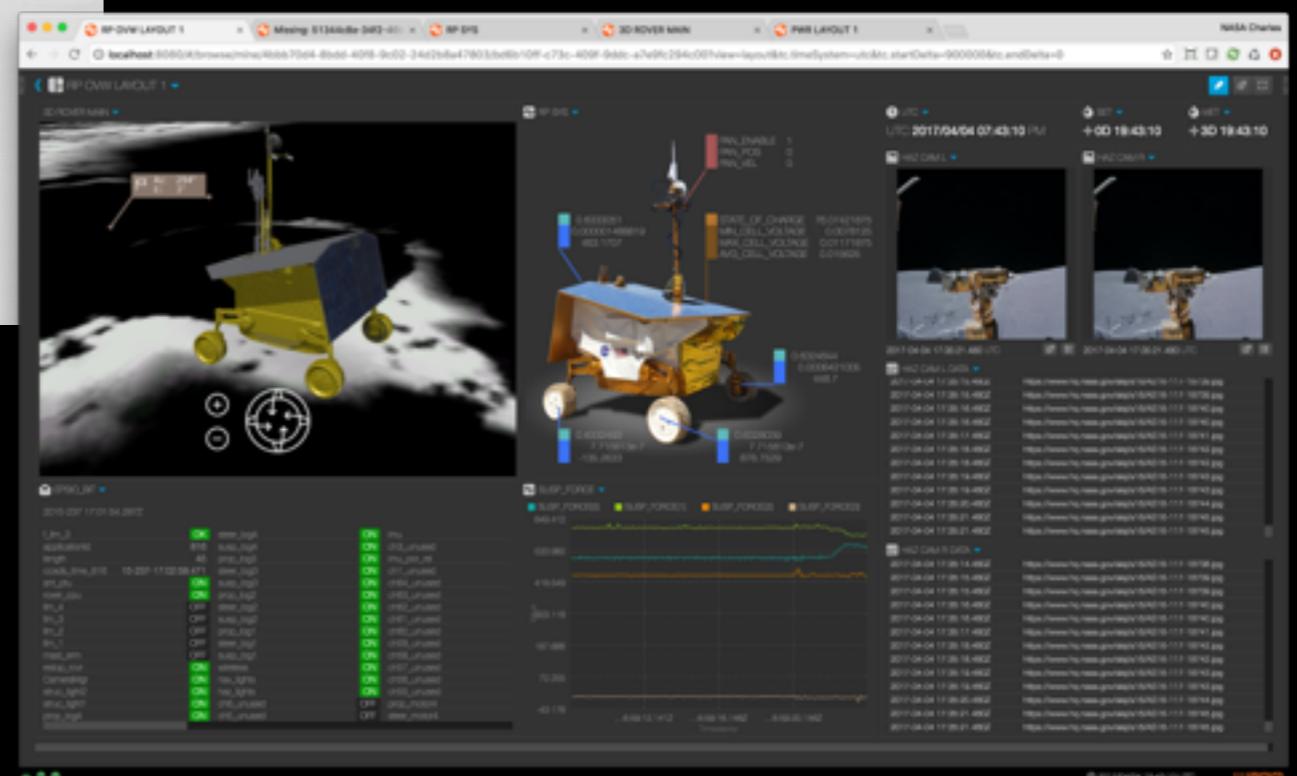
What do the consoles do?



A Long Way

3 7 0 DAY 1 0 1
 F/N 13/099 FSS CONTROL RR3408A CH044
 DGMT 101:18:12:32 OMET 4:04:14:32 SITE TDR OI 188 GN 62
 RGMT 101:18:12:32 U/D RATE 1 SM 64 BF 12

MECHANISM SELECTION	CONFIGURATION	TELEMETRY		
	ON A B	OFF A B	AMPS	TEMP
BERTH LAT 1	SCIU 16 *	17 *	SCIU 0.53	2
2	MSB 18	19 **	MSB 0.07	0
UMB MAIN 3	MPC 20 **	21	MPC 4.7	
HEATER 4	DPC 22	23 **	DPC 0.2	
RET LAT KEEL 5	LCKR 24 *	25	FSS LCKR 1	26
PORT 6				2
STBD 7				13
ROTATOR 8				
PIVOTER 9	HEATERS (SSP)			
TRANSLATOR 10	ENA	AMPS	PCU	5
PLAT LOCK 11	FSS *	0.2	PDSU	-1
DESELECT 12	SMM	0.1		
13	MACS	0.1		
OVERRIDE			FMDM 0.85	
ENABLE 14*			FMDM BOX A	26
DISABLE 15			B	-55↓
DEU			DISP MP	
1			2011 SM	
2 RESUME			2011 SM	
3			9 20119 GNCS	
4 RESUME			9 20119 GNCS	



Mental Models - Displays, Applications, Objects

from Gemini to Shuttle

Displays

Monochrome
Alpha-Numeric

Channel 1

Monochrome
Alpha-Numeric

Channel 73

Shuttle to ISS, Robotic Missions

Telemetry

Plot
Application

Alpha-
Numerics
Application

Timeline
Editor

Procedure
Viewer

Timeline
Editor

Procedure
Editor

Trajectory

MCT to WARP

Objects, Models, Views

Composition

View

View

View

View

View

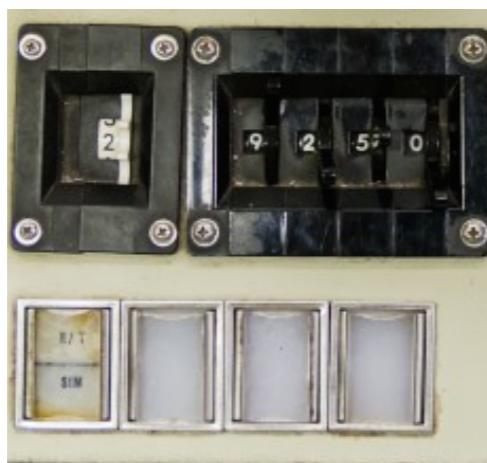
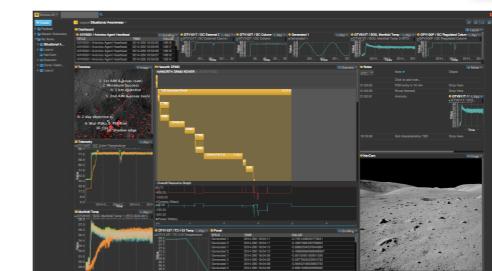
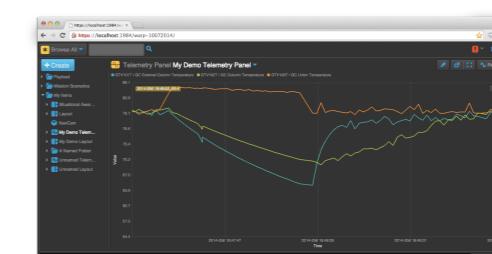
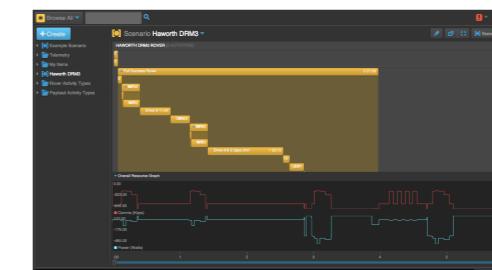
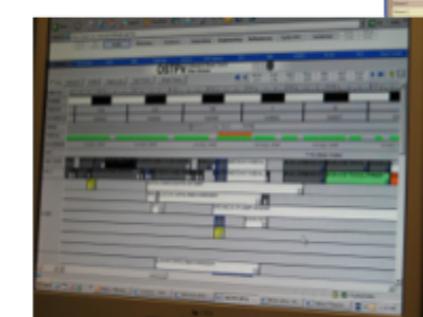
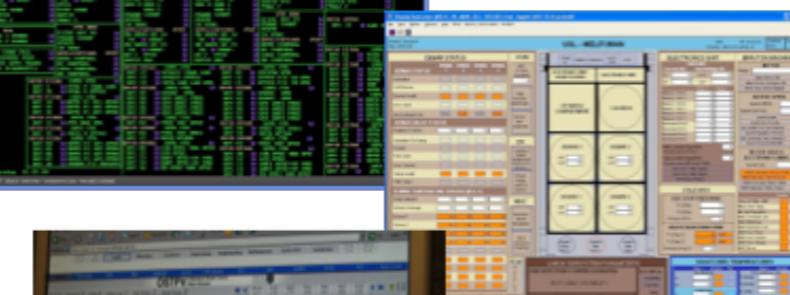
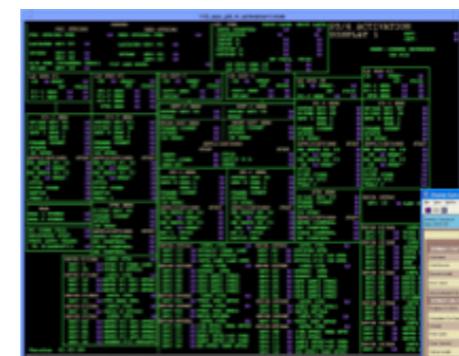
View

The Thing (Model)

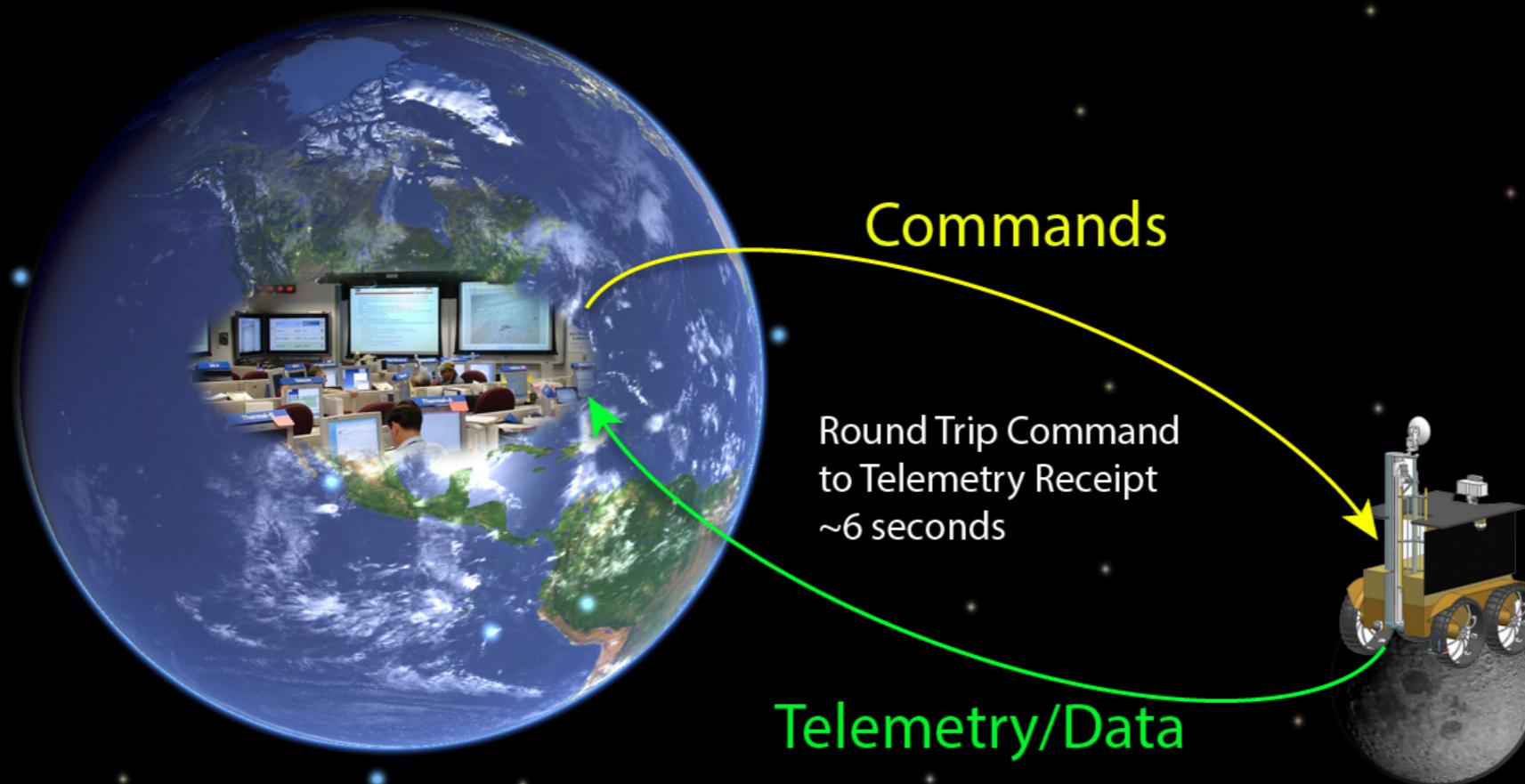
F/V 13/099 FSS CONTROL R83408A CH044
CGMT 1011:18:12:32 OWT 1:04:14:32 SITE TDR 01 180 GN 62
RGT 1011:18:12:32 U/D RATE 1 SN 64 BP 12

MECHANISM	SELECTION	ON	OFF	TELEMETRY
BERTH LAT 1	1	A B	4 S	AMPS TEMP
2	2	SCU 16 X	17 X	SCU 0.93 Z
3	3	HSD 16 X	18 X	HSD 0.07 9
UMB MAIN HEATER	4	HPC 20 X	21 X	HPC 0.07 7
RET LAT KEL	5	DPC 22 X	23 X	DPC 0.2
PORT 7	6	LCKR 24 X	25 X	FSS LCKR 1 Z
STBD 8	7			26 13
ROTATOR	9	HEATERS (200)		
PIVOTER	10	FSS 0.2	PCU	S
TRANSLATOR	11	SHM 0.1	PDGU	-1
PURGE	12	NACS 0.1		
DESELECT	13			
OVERRIDE				FHDM 0.05
ENABLE	14			FHDM BOX A 24
DISABLE	15			0 -854
DEU				DISP NP
				2011 SN
				2011 GNCS
				2011 GNCS
				2011 GNCS

DISP NP
2011 SN
2011 GNCS
2011 GNCS



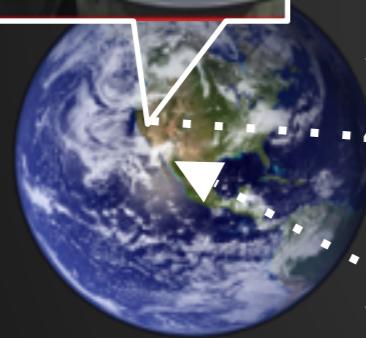
Resource Prospector



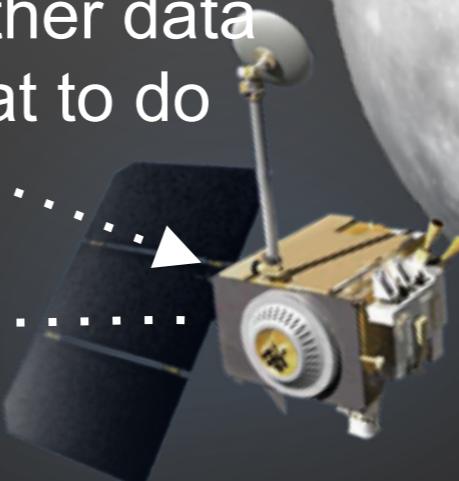
Physical Co-Location

- Why co-location?
- Gestures
- Face to face

Mission Operations



1. Monitor health & status
2. Examine science data
3. Examine other data
4. Decide what to do
next command
5. Command
spacecraft
telemetry
*y**



* Intermediaries (such as satellites and ground stations) omitted for simplicity.

Multi-Disciplinary Operations

Operations

Engineering

Science

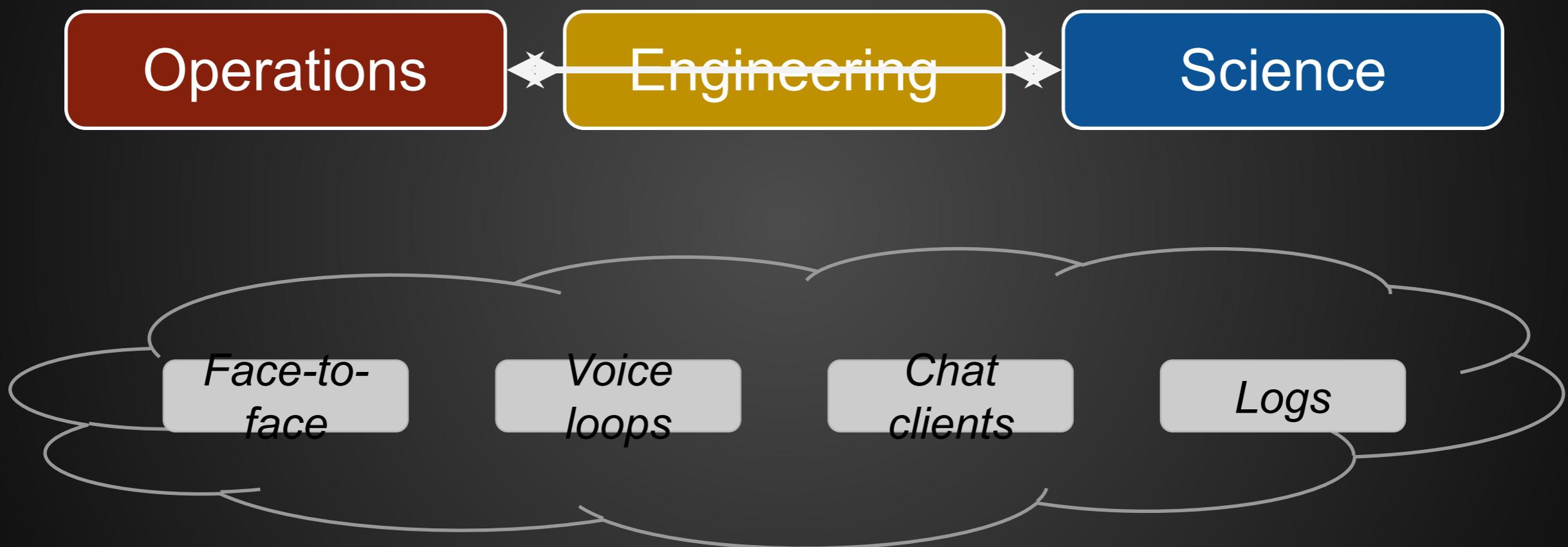
Flight directors,
planners, and
decision-makers
who conduct the
mission.

Specialists
monitoring the
health and status of
subsystems,
instruments

Experts in areas
pertinent to the
science goals of the
mission.

Personnel from many different areas of expertise collaborate and contribute toward achieving mission goals.
Effective communication is essential!

Multi-Disciplinary Communication



Mission Tools

Operations personnel use a broad variety of tools to work with a broad variety of data.

- Telemetry

- visualization

- Plots

- Alphanumerics

- Dense displays

- Telemetry

- dictionaries

- Data product

- viewers

- Imagery

- Spectra

- Procedures

- Viewers, editors

- Executors

- Planning tools

- Timeline-based

- Traverse-based

- Clocks, timers

- Session

- management

- Commanding

- Issue commands

- Sequencers

- Text editors

- Version control systems

- Webcams

- Console logs

- Simulators

Mission Requirements

New missions do new things.
The hardware, software, and human
processes that worked for one
mission may not be appropriate for



History

- The early Mercury Control Centers were distributed around the world
- Centralization became possible only with advances in communications and tracking networks